

In the Claims:

1. A thermal management system for a room having heat generating components, the system comprising:
  - an array of fan assisted tiles;
  - a fan controller coupled to each fan assisted tile; and
  - a thermal server coupled to each fan controller through a data network to receive sensed data based on environmental characteristics in the room and to output a control signal to each fan controller so that fans of each fan assisted tile can be controlled to provide an adaptive airflow balancing in the room.
2. The thermal management system of claim 1, further comprises:
  - sensors associated with each fan assisted tile, wherein the sensors are coupled to the remote server, and wherein the sensors sense environmental characteristics in the room and output sensed data.
3. The thermal management system of claim 2, wherein in the sensed data comprises data based on environmental characteristics selected from the group consisting of airflow, temperature, humidity, and particle density.
4. The thermal management system of claim 3, wherein the sensed data comprises environmental characteristics of air coming into and out of the room.
5. The thermal management system of claim 1, wherein the thermal server is a remoter computer program capable of communicating over the data network.
6. The thermal management system of claim 1, wherein the thermal server to output the control signal to control the fans to vary the environmental characteristics of air coming into and out of the room.

7. A thermal management system for a room having heat generating components, the system comprising:
- a first array of fan assisted tiles having sensors to sense airflow, wherein the fan assisted tiles direct the airflow into the room;
  - a second array of fan assisted tiles having sensors to sense temperature, wherein the fan assisted tiles direct the airflow out of the room; and
  - a remote server, coupled to the fan assisted tiles through a data network, receive sensed airflow data and temperature data from the sensors and, outputs a control signal to vary fan speeds of each fan assisted tile in the first and second arrays.
8. The system of claim 7, wherein the fan speed of each fan in the first array is based on sensed airflow of the incoming air at the fans.
9. The system of claim 8, wherein the speed of each fan is varied based on the control signal to provide adaptive thermal balancing in the room based on sensed airflow.
10. The system of claim 7, wherein the fan speed of each fan in the second array is based on sensed temperatures of the outgoing air at the fans.
11. The system of claim 10, wherein the fan speed of each fan is varied based on the control signal to provide adaptive thermal balancing in the room based on sensed air temperature.
12. The system of claim 7, wherein the remote server to send an alarm to indicate a failed condition of a failed fan assisted tile.
13. A networked fan system for a computer data center, wherein the computer data center comprises a raised floor and a ceiling, comprising:
- a first array of fan assisted tiles disposed on the raised floor, wherein each fan assisted tile assembly in the first array comprises one or more fans, an airflow sensor to output a first control signal, a micro-controller to vary the speeds of one or more fans, a

programmable switch to set a Network address, and an interface connectible to a power source;

a second array of fan assisted tiles disposed on the ceiling, wherein each fan assisted tile assembly in the second array comprises the one or more fans, a temperature sensor to output a second control signal, a micro-controller to vary the speeds of the one or more fans, a programmable switch to set the Network address, and an interface connectible to the power source;

a network coupled to the interface of each of the first and second array of fan assisted tiles; and

a host computer connectible to the network, wherein the host computer receives the first control signal along with the Network address associated with each fan assisted tile assembly in the first array through the network and outputs a third command signal along with the associated Network address based on the first control signal, wherein the host computer receives the second control signal along with the Network address with each fan assisted tile assembly in the second array through the network and outputs a fourth command signal along with the associated Network address based on the second control signal, and wherein the micro-controller associated with each of the first and second array of fan assisted tiles receives the associated third and fourth command signals through the network and varies a speed of one or more fans associated with each of the first and second array of fan assisted tiles to provide adaptive airflow balancing in the computer data center.

14. The networked fan system of claim 13, wherein the first array of fan assisted tiles is disposed such that air is directed into the computer data center when the fan assemblies are in operation.

15. The networked fan system of claim 13, wherein the second array of fan assisted tiles is disposed such that the air is directed out of the computer data center.

16. The networked fan system of claim 13, wherein the interface comprises:  
daisy chainable connection to connect each interface to the power source and the network.
17. The networked fan system of claim 13, wherein each fan assisted tile assembly comprises a sheet metal tile having a plurality of passageways, wherein the sheet metal tile further has a front side and a back side, wherein the one or more fans are attached to the back side of the sheet metal tile, and the front side is adapted to be disposed in the raised floor or the ceiling.
18. A fan assembly, comprising:  
a fan tile adapted to be disposed in a raised floor or a ceiling of a room;  
one or more fans attached to the fan tile; and  
a fan controller coupled to the one or more fans and connectible to a host computer via a network, wherein the fan controller to sense environmental characteristics and to output a first control signal along with a Network address, wherein the fan controller receives a second control signal along with a Network address from the host computer via the network, wherein the second control signal is based on the first control signal, and wherein the fan controller varies the speed of the one or more fans based on the second control signal to provide adaptive airflow balancing in the room.
19. The fan assembly of claim 18, wherein the fan controller comprises:  
a power controller coupled to the one or more fans;  
a programmable switch coupled to the power controller to set the Network address;  
an interface coupled to the power controller and connectible to the host computer via the network; and  
a sensor connectible to the host computer via the interface to sense the air flow of air coming into the room or the air temperature of air going out of the room when the one or more fans are in operation and to output the first control signal based on the sensed temperature or airflow, wherein the power controller to receive the second control signal

from the host computer based on the first control signal, and wherein the power controller to vary the one or more fans speed to provide adaptive airflow balancing based on the second control signal.

20. The fan assembly of claim 19, wherein the fan tile comprises a sheet metal tile.

21. The fan assembly of claim 19, wherein the one or more fans are one or more axial or radial fans.

22. The fan assembly of claim 19, wherein the sensor is selected from the group consisting of a temperature sensor, a humidity sensor, an airflow sensor, and a particle density sensor.

23. A remotely controlled fan assisted tile assembly for a computer data center, comprising:

- a fan tile adapted to be disposed in a raised floor or ceiling of a computer data center;

- one or more fans attached to the fan tile such that the one or more fans, when in operation, aid in adaptive airflow balancing of the computer data center; and

- a fan controller coupled to the one or more fans and connectible to a host computer via a network, wherein the fan controller further comprises:

- a micro-controller;

- a programmable switch coupled to the micro-controller to set a unique identifier; and

- a sensor connectible to sense outgoing or incoming environmental characteristics when the one or more fans are in operation and to output a first control signal along with the unique identifier based on the sensed environmental characteristics, and wherein the micro-controller to receive a second control signal from the host computer based on the first control signal and the unique identifier, and wherein the micro-controller controls the one or more fans to

provide adaptive airflow balancing based on the second control signal and the unique identifier.

24. The fan assisted tile assembly of claim 23, wherein the sensor is selected from the group consisting of a temperature sensor, an airflow sensor, a humidity sensor, and a particle density sensor.

25. The fan assisted tile assembly of claim 23, wherein the first control signal comprises data selected from the group consisting of temperature data and airflow data.

26. The fan assisted tile assembly of claim 23, wherein the second control signal comprises revolutions per minute (rpm) data.

27. The fan assisted tile assembly of claim 24, further comprising:  
an interface, wherein the interface comprises a network interface and a power line interface, to daisy chain with other fan assemblies.

28. The fan assisted tile assembly of claim 27, wherein the network interface comprises a serial communication interface.

29. The fan assisted tile assembly of claim 23, further comprising:  
an indicator to indicate a failed fan assisted tile assembly, wherein the indicator comprises devices selected from the group consisting of a light and an alarm.

30. A fan assisted tile assembly, comprising:  
a fan tile adapted to be disposed in a raised floor or ceiling of a computer data center, wherein the fan tile has a front side and a back side, and wherein the fan tile further has multiple passageways;  
one or more fans attached to the back side of the fan tile such that air passes through the multiple passageways when the one or more fans are in operation; and

a fan controller coupled to the one or more fans, wherein the fan controller further comprises:

- a power-controller coupled to the one or more fans;
- a programmable switch coupled to the power-controller to set a Network address that is unique to the fan assembly;
- an interface coupled to the power-controller; and
- a sensor connectible to a host computer via the interface to sense outgoing or incoming environmental characteristics and to output a first control signal, and wherein the power-controller is connectible to the host computer via the interface to receive a second control signal from the host computer based on the first control signal, and wherein the power-controller to vary the one or more fans speed to provide adaptive airflow balancing in the computer data center based on receiving the second control signal and the Network address.

31. The fan assisted tile assembly of claim 30, wherein the fan tile comprises a sheet metal tile.

32. The fan assisted tile assembly of claim 30, wherein the sensor is selected from the group consisting of a temperature sensor, an airflow sensor, a humidity sensor, and a particle density sensor.

33. The fan assisted tile assembly of claim 30, wherein the interface comprises a network interface and a power interface that can be daisy chained with other fan assisted tiles.

34. The fan assisted tile assembly of claim 30, further comprising:  
an indicator to indicate a failed fan assisted tile assembly.

35. A system for providing adaptive airflow balancing in a room having heat generating components, the system comprising:  
means for moving air into the room;

means for moving air out of the room; and  
means for controlling the means for moving air into and out of the room to provide adaptive airflow in the room.

36. The system of claim 35, wherein the room comprises a computer data center.

37. The system of claim 35, wherein the means for moving air into and out of the room comprises fan assisted tiles.

38. The system of claim 35, further comprising:  
a means to indicate a failed fan assisted tile assembly.

39. A method for providing adaptive thermal management of a room having heat generating components, comprising:

providing an adaptive airflow balancing in the room by using an array of fan assisted tiles that are controlled by a remote server based on sensed environmental characteristics in the room.

40. The method of claim 39, wherein the sensed environmental characteristics comprises:

sensing environmental characteristics of air coming into and out of the room.

41. The method of claim 40, wherein the sensing environmental characteristics comprises:

sensing environmental characteristics selected from the group consisting of airflow, temperature, humidity, and particle density.

42. A method, comprising:

sensing environmental characteristics of incoming air and outgoing air from first and second arrays of fan assisted tiles disposed in a raised floor and a ceiling in a room, respectively; and



controlling each fan assisted tile based on the environmental characteristics using a remote computer through a network to provide adaptive airflow balancing in the room.

43. The method of claim 42, wherein sensing environmental characteristics further comprises:

- sensing incoming airflow from each of the first array of fan assisted tiles; and
- sensing outgoing air temperature in each of the second array of fan assisted tiles.

44. The method of claim 42, wherein controlling each fan assisted tile based on the environmental characteristics further comprises:

- outputting a first control signal and an associated Network address by each fan assisted tile assembly to the remote computer based on the sensed environmental characteristics;

- receiving a second control signal and the associated Network address by each fan assisted tile assembly; and

- controlling each fan assisted tile assembly based on the received second control signal and the associated Network address to provide adaptive airflow balancing in the room.

45. The method of claim 42, wherein the room is a computer data center.

46. The method of claim 42, further comprising:

- sensing operating condition of each fan assisted tile in the first and second arrays;
- and

- indicating a failed condition of a fan assisted tile, based on the sensing of the condition of each of the fan assisted tiles, by sending an alarm or by lighting an indicator associated with the failed fan assisted tile.

47. A decentralized thermal management system for a room having heat generating components, the system comprising:

- an array of fan assisted tiles;

a fan controller coupled to each fan assisted tile; and  
a thermal server coupled to each fan controller through a data network to send commands to each fan controller for adaptive airflow balancing in the room, wherein each fan controller controls each associated fan assisted tile based on the received commands to achieve a required adaptive airflow balancing in the room.

48. The thermal management system of claim 47, further comprises:  
sensors associated with each fan assisted tile, wherein the sensors are coupled to the fan controller, and wherein the sensors sense environmental characteristics in the room and output sensed data.

49. The thermal management system of claim 48, wherein in the sensed data comprises data based on environmental characteristics selected from the group consisting of airflow, temperature, humidity, and particle density.

50. A distributed thermal management control system for a room having heat generating components, the system comprising:  
an array of fan assisted tiles;  
a fan controller coupled to each fan assisted tile;  
sensors associated with each fan assisted tile, wherein the sensors are coupled to the fan controller, wherein the sensors sense environmental characteristics in the room and output sensed data; and  
a thermal server coupled to each fan controller through a data network to monitor each fan controller, wherein each fan controller controls each associated fan assisted tile based on sensed data received from associated sensors and other sensors coupled through the data network to achieve an adaptive airflow balancing in the room, wherein the thermal server outputs status conditions of each fan assisted tile.

51. The thermal management system of claim 50, wherein in the sensed data comprises data based on environmental characteristics selected from the group consisting of airflow, temperature, humidity, and particle density.